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Suppliers' Information Note

For The BT Network

BT Downstream 21CN Ethernet Services

Service Description

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1. Introduction

This Suppliers' Information Note (SIN) describes the BT Downstream 21CN Ethernet Services. The services offer access options using Ethernet accesses at different rates and using a range of access technologies. This document provides information about the service for use by Customer Premises Equipment (CPE) manufacturers and developers.

Note that "BT Downstream 21CN Ethernet Services" is shortened to "BT Ethernet" throughout this document. Also, various BT Lines of Business may market the 21CN Downstream Ethernet services using alternative names, but each will refer their product specific documentation back to this SIN.

This SIN should be read in conjunction with access specific SINs detailed in Section 17.

2. Service Availability

BT Ethernet is available across the United Kingdom of Great Britain & Northern Ireland, with the current exception of the Isle of Man.

BT Ethernet will be offered as "subject to survey". Excess construction charges will apply where appropriate.

Stand-by Power (Battery Back-Up) is not available for BT Ethernet - the customer can use their own UPS if desired.

For further information on service availability and tariffs please contact your company's BT Account Manager.

If you have enquiries relating to this document, then please contact: sinet.helpdesk@bt.com

3. BT Ethernet Service Description

BT Ethernet is an Ethernet VPN service (uses IEEE802.3 framing), which utilises BT's 21st Century Network to provide connectivity between two or more sites to form an Ethernet (Layer 2) Virtual Private Network.

The service is comprised of 2 fundamental building blocks: "Etherways" and "Etherflows".

- Etherways are access circuits that link a customer site to a port in a 21C Ethernet Point of Presence (PoP).
- Etherflow connections or "Etherflows" for short, are the logical Layer 2 connections/data transmission path from one customer site to another.

Etherflows come in two variants; Etherflow Connected (ELINE) and Etherflow Dynamic (ELAN).

The ELINE topology of the VPN can be point-to-point (Ethernet Private Line - EPL) or hub and spoke (Ethernet Virtual Private Line - EVPL). Meshed topologies can also be built using point-to-point connections.

Where ELAN is deployed, an any-to-any topology is obtained. ELAN utilises "Etherflow Dynamic" virtual paths connected to a logical ELAN CUG (closed user group) rather than a point to point "Etherflow Connected".

See Section 12 for further detail.

ELAN and ELINE can co-exist on the same Etherway (excluding Etherway Radio).

3.1 Etherway

There are a variety of technologies that can be used to provide an Etherway: -

1. Etherway Copper
    - Ethernet First Mile (EFM - 802.3ah, ITU-T G.991.2 (G.SHDSL.bis)) defines how Ethernet can be transmitted over new media types using new Ethernet physical layer (PHY) interfaces, including voice-grade copper.
    - BT's EFM access solution uses up to eight bonded copper pairs, to offer a reliable and high-performance access mechanism. In the event of one or more copper pairs suffering failure, the service will be maintained, however at a reduced rate using the remaining pairs. The bonded copper pair failures should be transparent to the end Customer although the overall SDSL bandwidth will reduce accordingly. Single pair service provisions would result in service impact. It should be noted that where possible BT minimises the impact of bonded pair failures to the end customer by over provisioning the SDSL bandwidth above the Committed Ethernet Rate (CIR) offered to the Customer.
    - Uses Openreach LLU MPF copper products together with Ethernet First Mile (EFM - copper) electronics.
    - Note that EFM based accesses are no longer offered to customers for new supply.
2. Etherway (Fibre)
    - Uses Openreach fibre access-based products; EAD10, EAD100, EAD1000 and EAD10G.
    - Refer to SIN492 and SIN519 for more details.
    - Etherway (Fibre) will soon support 1000Base-T electrical client interfaces (in development).
    - Note that EAD10 based accesses are no longer offered to customers for new supply.
3. Etherway Exchange Connect (EEC)
    - Uses an Openreach Cablelink to present either 1GE, 10GE or 100GE via an Optical Patch Panel.
    - Refer to SIN1001 for more details.
4. Etherway Radio
    - Presents 10Mbps and 100Mbps services where Etherway (Fibre) is not available or where high Excess Construction Charges (ECC) apply. Service is limited to Etherflow Connected services only.
5. Etherway Superfast GEA
    - Uses Openreach SOGEA/FTTC/FTTP products.
    - Note that FTTC based accesses are no longer offered to customers for new supply.

- Refer to SIN498, SIN506 and SIN517 for more details.

6. Etherway Data Centre Bespoke Access
    - Presents a 1GE, 10GE or 100GE port directly off a 21C Ethernet PoP at a Data Centre via a patch panel. There is no requirement for a subsequent BT provided access product.
7. Etherway Hull Bespoke Access
    - Presents 10M, 100M or 1GE services via a 3rd party access provider from a Hull located 21C Ethernet PoP.
8. Etherway 10G Bespoke Access
    - Uses Openreach OSA services to provide 10G access.
    - Refer to SIN489 for more details.
9. Etherway Radio Bespoke Access
    - Presents 10Mbps and 100Mbps services where Etherway (Fibre) is not available or where high ECC charges apply. Service supports both Etherflow Connected and Etherflow Dynamic services.
10. Megareach Access
    - Presents 100Mbps services using a combination of N x Radio or N x EAD100 or a mixture of Radio and EAD daisy chained access technology hops to provide enhanced access reach where existing solutions cannot meet the customer access reach requirements. The service is planned to be launched in 2024/25 FY.

3.2 Etherflow

Etherflows comes in two variants:-

1. "**Etherflow Connected**" provides point to point Ethernet Virtual Connections (EVCs) between customer sites.
2. "**Etherflow Dynamic**" provides a data transmission path from the customer site to a virtual Layer 2 LAN within the 21C network. It is a Layer 2 Ethernet service supporting broadcast and multicast applications (limitations apply – see Section 12). Etherflow Dynamic can be used with all Etherway access types (see restrictions below) and can be used alongside or as an alternative to point-to-point Etherflows.

Note that: -

- Etherway Radio does not support Etherflow Dynamic (ELAN).
- Etherway Radio Bespoke Access supports both Etherflow Connected (ELINE) and Etherflow Dynamic (ELAN).
- Megareach Access supports both Etherflow Connected (ELINE) and Etherflow Dynamic (ELAN).

4. Physical Properties of the NTEs

4.1 Etherway (Fibre)

Uses Openreach fibre-based access products; EAD10, EAD100, EAD1000 and EAD10G. This includes Local Access, Standard Reach and Extended Reach variants where supported.

4.1.1 EAD10, 100 & 1000

Two versions of the NTE are used depending on the anticipated demand at the customer site.

Slimline NTE **-** The slimline NTE may be stand alone, be wall mounted or be rack mounted in a standard 19” cabinet and is 1U high. The slimline NTE would normally be deployed at small sites or where there is not likely to be high demand for accesses.

- Dimensions: 439mm x 44mm x 270mm (W x H x D)
- Power Supply: Choice of 48V DC or 2 * 50Hz AC 13amp power sockets are required running off the same phase
- Power Consumption <30 Watts

Note that Openreach have recently stopped deploying this version of the slimline NTE in preference for a newer more power efficient NTE.

- Dimensions: 436mm x 44mm x 211mm (W x H x D)
- Power Supply: Choice of 48V DC or 2 * 50Hz AC 13amp power sockets are required running off the same phase
- Power Consumption ~15 Watts

Chassis NTE **-** The modular chassis NTE is rack mounted in a standard 19” cabinet and is 4U high. Height consideration for fibre routing also needs to be considered. 1U is required for customer cable management and in each rack there needs to be space for a 4U fibre splicing tray.

The chassis NTE would normally be deployed at sites where there is likely to be four or more Openreach EAD products terminating in a twelve-month period. Up to 15 NTE cards can be provided in a single chassis.

- Dimensions: 438mm x 175mm x 232mm (W x H x D)
- Power Supply: Choice of 48V DC or 2 * 50Hz 240V AC 13amp power sockets are required running off the same phase
- Power Consumption: 220 Watts (fully loaded)

Note that Openreach have recently stopped deploying the chassis based NTE in preference for a smaller slimline multiport NTE. This NTE supports EAD100, EAD1000 and EAD10G services.

- Dimensions: DC powered - 443mm x 44mm x 205.5mm (W x H x D)
- Dimensions: AC powered - 443mm x 44mm x 366.6mm (W x H x D)
- Power Supply: Choice of 48V DC or 2 * 50Hz 240V AC 13amp power sockets are required running off the same phase
- Power Consumption: 120 Watts (fully loaded)

4.1.2 10G EAD

The Openreach EAD NTE provides a 10G Ethernet bearer between the Customer Premise and the 21C Ethernet PoP. The Customer interface will be offered via a 1U NTE using Dual LC interfaces.

The NTE supplied at the customer is a single slot standalone NTE.

- Dimensions: 1U high NTE are (443mm x 44.4mm x 220mm WxHxD)
- Power Supply: Choice of dual -50 Volt DC or dual 240 Volt 50Hz AC (13amp power sockets are required running off the same phase)
- Power Consumption: 63 Watts (typical)
- The Temperature and humidity range of the environment used to house the NTE must not exceed the following:
    - Ambient room temperature: 0°C to +40°C
    - Relative humidity 5% to 95%
    - Passive Cooling

Note that Openreach have recently stopped deploying this version of the 10G NTE in preference for a smaller slimline multiport NTE. This NTE supports EAD100, EAD1000 and EAD10G services.

- Dimensions: DC powered - 443mm x 44mm x 205.5mm (W x H x D)
- Dimensions: AC powered - 443mm x 44mm x 366.6mm (W x H x D)
- Power Supply: Choice of 48V DC or 2 * 50Hz 240V AC 13amp power sockets are required running off the same phase
- Power Consumption: 120 Watts (fully loaded)

4.2 Etherway Copper

Uses Openreach LLU MPF copper products (SIN 349) together with Ethernet First Mile (EFM - copper) electronics. The solution is compliant to the UK Access Network Frequency Plan.

The NTE can be stand-alone, wall mounted or be rack mounted in a standard 19” cabinet and is 1U high.

- Dimensions: 216mm x 35mm x 197mm (W x H x D)
- Power Supply: 1 * 50Hz AC 13amp power socket is required
- Power Consumption 12 Watts

EFM characteristics include: -

- Uses IEEE 802.3 ah standards [2]
- Uses ITU-T G.991.2 (G.SHDSL.bis) [3] technology
- Provides Symmetrical bandwidths that align with the ANFP (Access Network Frequency Plan)
- Delivers spectrally friendly symmetrical data rates
- Multi-pair operation provides more bandwidth and redundancy
- Each packet is fragmented & reassembled utilizing all circuits in 2BASE-TL bonded group

4.3 Etherway Exchange Connect

Uses the Openreach Cablelink product.

Services using this access type are restricted to CPs that have a presence in the BT exchange building.

Connectivity to this service is via an optical patch panel located in the multi-user area (MUA) of the exchange building. Bandwidth is available at 1Gbps, 10Gbps and 100Gbps.

For identification of transmit and receive legs of Hydra cables, the convention is that transmission from BT Transmission equipment (e.g., DWDM) to the Customer Patch Panel will be to the odd fibre on the Cablelink.

Transmission from the Customer Patch Panel to BT Transmission equipment will always be to the even fibre i.e., 2, 4 & 6 on the Cablelink.

Please note, when repairing Hydra cables, please ensure this convention is followed.

4.4 Etherway Radio/Etherway Radio Bespoke Access

The Radio system comprises both internal equipment and external equipment mounted aloft on the rear of the Antenna. The external equipment is powered directly from the internal equipment via a single coaxial cable.

Indoor Equipment (INU)

- Guaranteed -5° to +45° C
- Extended -5° to +55° C
- 44mm (1RU) x 482mm x 290mm (or 345mm with required recess bracket) [HxWxD]
- Weight ~4.2kg
- -48V DC, 50-54W (for a 1+0 system)

New Radio system provides post FY2021 will use an upgraded INU. The main deltas are: -

- 44mm (1RU) x 482mm x 282.5mm [HxWxD]
- Weight ~4.8kg

The internal equipment is designed to be installed within a rack using 19inch fixings. All connections are on the front of the INU. The INU can be mounted with the front face in line with the 19” fixings, or recessed 55mm to allow for the bending radius of the incoming cables.

It is recommended that a 5Amp fuse is fitted in line with the DC power to the INU.

Outdoor Equipment (ODU)

- Guaranteed -33° to +55° C
- Extended -50° to +65° C
- The ODU dimensions are 287mm x 287mm
- The weight of the ODU is 6.4kg (14lb)
- The weight of a typical 0.3M diameter Antenna is 6.5kg

The outdoor equipment consists of the ODU containing the electronics, which is attached to the Antenna. Typically, the antenna size will be 0.3m, 0.6m, 1.2m in diameter and is dependent on the link length.

Power

- The input to the INU is -48volts. There is an optional wall mounted AC /DC power unit providing 75watts (DC) which is sufficient for a 1+0 radio system.
- For over-water implementations, the maximum power will be 150W (3A at -50v per radio endpoint)

4.5 Etherway Superfast GEA

Uses Openreach SOGEA/FTTC/FTTP products.

Two versions of the NTE are used depending on the access technology (FTTC/SOGEA or FTTP).

For FTTP based connections – The ONT (Optical Network Terminating unit) is a wall mounted device, deployed within the customer premises terminating the FTTP fibre.

- Dimensions: 155mm x 195mm x 34mm (W x H x D)
- Power Supply: 1 * 50Hz AC 13amp power socket is required
- Power Consumption <12 Watts

For FTTC/SOGEA based connections

Historically, FTTC customer presentation was via an Openreach VDSL modem (see details below). Early in 2016, the modem was withdrawn by Openreach after which the customer presentation changed to a NTE5 (“Wires Only GEA”).

For Wires Only GEA access, The CP will require a micro-filer for correct functionality. Refer to SIN498 and SIN517 (Generic Ethernet Access Fibre to the Cabinet (GEA-FTTC)) for details.

Where an Openreach VDSL modem is provided, the following modem specification will apply.

The VDSL Active NTE is a free-standing device, deployed within the customer premises terminating the FTTC connection.

- Dimensions: 120mm x 29mm x 162mm (W x H x D)

- Power Supply: 1 * 50Hz AC 13amp power socket is required
- Power Consumption <6.5 Watts

4.6 Etherway Data Centre Bespoke Access

Etherway Data Centre Bespoke Access allows the Data Centre customer to connect directly to a 21C Ethernet PoP at 1GE, 10GE or 100GE (via an optical Patch Panel).

It is the Customer's responsibility to provide the physical connectivity from the Patch Panel to their CPE.

4.7 Etherway Hull Bespoke Access

Etherway Hull Bespoke Access allows customers within the Hull area to connect to a Hull located 21C Ethernet PoP using fibre-based accesses provided by the local incumbent access provider.

4.8 Etherway 10G Bespoke Access

The Openreach OSA NTE is supplied to provide a 10G DWDM bearer between the Customer Premise and the 21C Ethernet PoP. Customer interfaces will be offered via an optical patch panel or directly on a 1U or 7U NTE using Dual LC interfaces.

1U Chassis

- Dimensions : OSA 1U chassis requires a minimum of 5U space.
    - 1U for each chassis
    - 1U for the network management router
    - 1U for each customer Panduit cable management
    - 1U for each customer patch panel
    - 1U for Network Patch Panel
- Power Supply:
    - NTE: 2 * 240V (50Hz) AC 13amp power sockets are required
    - Management Router: 1 * 240V (50Hz) AC 13amp power socket is required (for non-RO1 services)
- Power Consumption: OSA 1U Chassis/cards consumes up to 240W (max). Plan for 44W.

7U Chassis

- Dimensions : OSA 7U chassis requires a minimum of 11U space.
    - 7U for each chassis
    - 1U for the network management router
    - 1U for each customer Patch panel
    - 1U for Panduit cable management system
    - 1U for Network Patch Panel
- Power Supply:
    - NTE: 2 * 240V (50Hz) AC 13amp power sockets are required

  - Management Router: 1 * 240V (50Hz) AC 13amp power socket is required (for non-RO1 services)
- Power Consumption: OSA 7U Chassis/cards consumes up to 428W (max). Plan for 76W.

4.9 Megareach Access

The NTE will either be a Radio based NTE (refer to Section 4.4) or an Etherway Fibre (EAD100) NTE (refer to Section 4.1.1).

5. Access Resilience Options

Access Type	Etherway Copper	Etherway Fibre		Etherway Exchange Connect	Etherway Data Centre Bespoke Access	Etherway Hull Bespoke Access	Etherway 10G Bespoke Access	Etherway Radio/ Etherway Radio Bespoke Access	Etherway Superfast GEA	Megareach Access
	10Mbps, 100Mbps	**10Mbps, 100Mbps & 1Gbps**	**10Gbps**	**1Gbps, 10Gbps & 100Gbps**	**1Gbps, 10Gbps & 100Gbps**	**10Mbps, 100Mbps & 1Gbps**	**10Gbps**	**10Mbps/ 100Mbps**	**10Mbps, 100Mbps & 1Gbps**	**100Mbps**
Delivery Method	**EFM LLU MPF**	**Openreach EAD**	**Openreach EAD**	**Openreach Cablelink**	**N/A**	**3rd Party Access OLO**	**Openreach OSA**	**Radio**	**Openreach SOGEA/FTTC/ FTTP**	**Radio and/or EAD**
Standard	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Protected	N	Y*	Y*	N	N	N	N	N	N	N
Diverse	N	Y**	Y**	Y**	N	N	Y**	N	N	Y**
Diverse (Split Site)	N	Y**	Y**	N	N	N	Y**	N	N	Y**
Diverse +	N	Y**	Y**	N	N	N	Y**	N	N	Y**
Diverse+ (Split Site)	N	Y**	Y**	Y**	N	N	Y**	N	N	Y**

Table 1: Access Resilience Options

*	Not available for new supply

**	Done on a best endeavours basis

6. Interface Types and Connectors

Access Type	Interface(s)	Connector Types	Duplex Setting
Etherway Copper	10 Base-T MDI* 100Base-T MDI*	RJ45 RJ45	Full Duplex Only
Etherway (Fibre) 10Mbps	10Base-T MDI/MDI-X**	RJ45	Full Duplex Only
Etherway (Fibre) 100Mbps	100Base-T MDI/MDI-X**	RJ45	Full Duplex Only
Etherway (Fibre) 1Gbps	1000Base-T MDI/MDI-X** 1000Base-LX (SMF) 1000Base-SX (MMF)	RJ45 Dual LC Dual LC	Full Duplex Only
Etherway (Fibre) 10Gbps	10GBase-LR (SMF) – LAN PHY	SC/PC	Full Duplex Only
Etherway Exchange Connect 1Gbps	1000Base-LX (SMF)	SC/APC	Full Duplex Only
Etherway Exchange Connect 10Gbps	10GBase-LR (SMF) – LAN PHY	SC/APC	Full Duplex Only
Etherway Exchange Connect 100Gbps	100GBase-LR4 (SMF) – LAN PHY	SC/APC	Full Duplex Only
Etherway Radio / **Etherway Radio Bespoke Access**	100Base-T MDI/MDI-X**	RJ45	Full Duplex Only
Etherway Superfast GEA (FTTP)	10Base-T/100Base-T/1000Base-T	RJ45	Full Duplex Only
Etherway Superfast GEA (FTTC/SOGEA)* **	10Base-T/100Base-T	RJ45	Full Duplex Only
Etherway Data Centre Bespoke Access	1000 Base-LX (SMF) 1000 Base-SX (MMF) 10GBase-LR (SMF) – LAN PHY 100GBase-LR4 (SMF)	SC/PC SC/PC Dual LC Dual LC	Full Duplex Only
Etherway Hull Bespoke Access	10Base-T 100Base-T 1000 Base-SX (MMF)	RJ45 RJ45	Full Duplex Only
Etherway 10G Bespoke Access (OSA)	10GBase-LR (SMF) – LAN PHY	Dual LC	Full Duplex Only
Megareach Access **(EAD100 and Radio)**	100Base-T MDI/MDI-X**	RJ45	Full Duplex Only

Table 2: Interface Types and Connectors

*The Etherway Copper NTE uses an MDI interface, i.e., a straight through cable is required (by default).

**The NTEs use MDI/MDI-X autocross capability on the RJ45 port to automatically compensate for the use of an incorrect cable type, for example if a crossed Cat 5 Ethernet cable is used instead of a straight one (or vice-versa).

***Where GEA-FTTC “Wires Only” presentation is provided, this will be via an NTE5.

7. Auto-negotiate Settings

Access Type	**Etherway Copper**	**Etherway Fibre**			**Etherway Exchange Connect**	**Etherway Data Centre Bespoke Access**	**Etherway Hull Bespoke Access**	**Etherway 10G Bespoke Access**	**Etherway Radio/ Etherway Radio Bespoke Access**	**Etherway Superfast GEA**	**Megareach Access**
	10Mbps, 100Mbps	**10Mbps, 100Mbps**	**1Gbps**	**10Gbps**	**1Gbps, 10Gbps & 100Gbps**	**1Gbps, 10Gbps & 100Gbps**	**10Mbps, 100Mbps & 1Gbps**	**10Gbps**	**100Mbps**	**10Mbps, 100Mbps & 1Gbps**	**100Mbps**
Delivery Method	**EFM LLU MPF**	**Openreach EAD**	**Openreach EAD**	**Openreach EAD**	**Openreach Cablelink**	**N/A**	**3rd Party Access OLO**	**Openreach OSA**	**Radio**	**FTTC/ FTTP/ SOGEA**	**Radio / EAD**
Auto-neg setting **(on Customer interface)**	OFF	ON* (selectable)	ON*	N/A	1G = ON 10G/100G = N/A	1G = ON 10G/100G = N/A	ON*	N/A	OFF	ON**	ON for both Radio and EAD based customer presented terminations No option to select OFF.

Table 3: Auto-negotiation Settings

*If the customer chooses Auto-negotiation Disabled, the customer must also specify the required MDI Mode (MDI or MDI-X), because the NTE does not support Auto MDI/MDI-X when Auto-negotiation is disabled.

** The customer’s equipment needs to be set to Auto-negotiate “ON” in order to work correctly with the Etherway service & the NTE will negotiate interface speed.

8. Link Loss Forwarding

Link Loss Forwarding (LLF) is a facility that assists in the identification and diagnosis of faults. Essentially, LLF enables a communication provider’s equipment (or an end user customer equipment) to be signalled automatically when a problem is detected on their equipment at the other end of the circuit or when the transmission link fails. Two variants are possible: -

8.1 Network to Access LLF

This allows a loss of data connection on the Etherway to be propagated to the customer. This is supported for Port based, VLAN based and Stacked VLAN services, unless otherwise stated.

- For Etherway (Fibre) when a break is detected on the Etherway the client access port is shut down to indicate the state of the infrastructure. This continues until such time as the network break is repaired. Note that in the event of a break detection, only the affected Etherway client port is shut down, all other client ports on the VPN remain operational.

- For Etherway 10G Bespoke Access, Network Link Loss Forwarding is signalled using Local Fault as per IEE802.3.
- On Etherway Copper, Etherway Exchange Connect, Etherway Data Centre Bespoke Access & Etherway Superfast GEA, Network Link Loss Forwarding is not used.

8.2 Access User Link Loss Forwarding

Not offered as part of this service.

9. Frame Sizes Supported

On all Etherway types the minimum frame size supported is 64 bytes.

Access Type	Etherway Copper	Etherway Fibre			Etherway Exchange Connect	Etherway Data Centre Bespoke Access	Etherway Hull Bespoke Access	Etherway 10G Bespoke Access	Etherway Radio/ Etherway Radio Bespoke Access	Etherway Superfast GEA	Megareach Access
	10Mbps, 100Mbps	**10Mbps, 100Mbps**	**1Gbps**	**10Gbps**	**1Gbps, 10Gbps & 100Gbps**	**1Gbps, 10Gbps & 100Gbps**	**10Mbps, 100Mbps & 1Gbps**	**10Gbps**	**100Mbps**	**10Mbps, 100Mbps & 1Gbps**	**100Mbps**
Delivery Method	**EFM LLU MPF**	**Openreach EAD**	**Openreach EAD**	**Openreach EAD**	**Openreach Cablelink**	**N/A**	**3rd Party Access OLO**	**Openreach OSA**	**Radio**	**Openreach SOGEA/FTTC/ FTTP**	**Radio/EAD**
MTU* (bytes)	1600	9000**/***	9000**/***	9000***	9000***	9000***	2000	9000***	9000***	1530	9000**/***

Table 4: Service Frame Sizes Supported

* Maximum Transmission Unit

When an EVC routes between 2 different Etherway types the MTU supported is the lowest of the 2 access types.

** MTU size is restricted to 2000bytes if an Openreach EAD10Mbps, 100Mbps or 1Gbps access is used with copper presentation on the "older" Openreach NTEs.

*** MTU is set to 9000bytes for new provides on the Etherflow Connected service. Existing Etherflow Connected services will retain a 2000bytes max MTU. Support for 9000bytes MTU on the Etherflow Dynamic service will be launched shortly.

10. Etherflow Bandwidth Sizes Supported

A range of Etherflow (Etherflow Connected & Etherflow Dynamic) bandwidths are available from 200kbps to 10Gbps. All Etherflow bandwidths can be used across all Etherway types up to the bandwidth of the Etherway itself. Etherflow bandwidths more than 1G are only supported off 10GE and 100GE Etherways.

10.1 Large Etherflows

Etherflow bandwidths greater than 1G, i.e., large Etherflows from 1.5Gbps, 2Gbps, 2.5Gbps, 3Gbps, 3.5Gbps, 4Gbps, 4.5Gbps, 5Gbps, 5.5Gbps, 6Gbps, 6.5Gbps, 7Gbps, 7.5Gbps, 8Gbps, 8.5Gbps, 9Gbps, 9.5Gbps and 10Gbps are supported via 10GE and 100GE enabled Etherways. Large Etherflows are currently only available on Etherflow Connected services with Etherflow Dynamic services currently in development.

These bandwidth options are only suitable where customer traffic uses multiple service flows within the large Etherflow, i.e., variations in the IP address or MAC address must be apparent.

For further guidance and clarification please refer to your BT Account Manager.

11. Etherflow Connected (ELINE)

There are limitations on the maximum number of Etherflows allowed per Etherway:

Interface Type	**10Base-T** **100Base-T** **1000Base-T**	**1000Base-LX** **1000Base-SX**	**10GBase-LR** **100GBase-LR4**
Max. Number of EVCs	**120**	**400**	**1500**

Table 5: Etherflow Connected Instances per Etherway

Traffic is policed at the ingress port on the Ethernet switch in BT's 21CN PoP. If a customer selects Etherflow size(s) less than the Etherway bandwidth it is advisable to shape their traffic to the Etherflow size.

12. Etherflow Dynamic (ELAN)

Etherflow Dynamic service characteristics are defined below:

- All Etherways in a given ELAN must have the same port status (Port / VLAN aware)
- Maximum of 50 Etherflow Dynamic EVC's per ELAN[1]
- Maximum of 35 Etherflow Dynamic ELAN's per Etherway (for all interface presentation options)
- Maximum of 1 Etherflow Dynamic from the same Etherway into an ELAN
- Maximum of 2000 MAC addresses presented per ELAN[2].
- Maximum of 250Mbps Real Time traffic per Etherway for all Etherflows ≤1G. For Etherflows >1G, then a maximum of 1Gbps of Real Time traffic per Etherway.

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[1] In some circumstances more than 50 Etherflow Dynamic EVCs per ELAN may be permitted when specifically authorised by BT Network design. For more details speak to Product Line.

[2] If a customer sends more than 2,000 MAC addresses into the ELAN, they risk poor performance.

- Maximum of 500kbps Multicast traffic (not including Layer 2 Control Protocols) per Etherflow Dynamic. Etherflow Dynamic EVCs can be used on any Etherway type (Fibre, Copper & Exchange connect) apart from Etherway Radio, and with all resilience options[3].
- To ensure optimum performance of the Class of Service policy it is not recommended to mix Etherflow Connected and Etherflow Dynamic EVCs on Etherway (copper).
- Ingress and Egress bandwidth (and associated Class of Service) needs to be appropriately dimensioned for the expected traffic flows.
- All CPE devices on an ELAN will be adjacent to each other in routing terms.
- Layer 2 loops and broadcast storms need to be avoided.

13. Etherflow Class of Service (CoS)

Class of service markings allow customers to inform BT about the relative priority of their data packets. This ensures that in abnormal network conditions (such as fault situations), or if the customer sends too much data to an egress point, the customer’s high priority traffic gets through.

There are four Etherflow CoS Options. Two are aware of customer CoS markings (Default-CoS and Multi-CoS) and two are not aware of customer markings (Standard and Premium).

- Standard: Standard traffic is classified as Low Priority across the 21C Core. 20% of customer traffic is marked as In Contract with any remaining being marked out of contract. Out of contract traffic may be discarded in the event of network congestion.
- Premium: Premium traffic is classified as Medium Priority across the 21C core with 100% of traffic marked In Contract.
- Default-CoS/Multi-CoS: (“Default-CoS” and ”Multi-CoS”, both use Ethernet 802.1p bits to mark the priority as shown in the following table:

802.1p	**Multi-CoS**	**Default-CoS**
7	Low Priority (In Contract)	Low Priority (In Contract)
6	Low Priority (In Contract)	Low Priority (In Contract)
5	High Priority	Low Priority (In Contract)
4	Low Priority (In Contract)	Low Priority (In Contract)
3	Medium Priority (In Contract)	Low Priority (In Contract)
2	Medium Priority (Out Contract)	Low Priority (In Contract)
1	Low Priority (Out Contract)	Low Priority (Out Contract)
0	Low Priority (In Contract)	Low Priority (In Contract)

Table 6: Class Of Service 802.1p Mappings

With Multi-CoS, traffic is policed to the overall purchased bandwidth (so 100% of traffic can be In Contract) and the High Priority traffic is policed to the purchased amount of High Priority traffic.

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[3] Though the customer will have to take steps to remove loops with some resilience options.

With Default-CoS, traffic is policed to the overall purchased bandwidth. Only 20% of traffic can be marked In Contract. Traffic exceeding this will be treated as out of contract across the BT network. Out of contract traffic may be discarded in the event of network congestion.

If a customer chooses Port mode, the BT CoS policy will interact with 802.1p bits sent in the data packet (which may be intended for customer only use).

If a customer chooses Port mode and does not place any 802.1p bit in the packet the BT CoS policy will transmit the packet through the Low Priority In-Contract queue.

13.1 CoS and ELAN services

With ELAN Etherflows, Broadcast and Multicast traffic from the customer is classified as Low Priority (In Contract) and limited to 500kbps by default.

In addition to classifying traffic based on the 802.1p value, the customer Layer 2 control traffic (ARP, IEEE group MAC addresses (e.g., STP) and IETF local network control traffic (e.g., OSPF)) shall be classified as Medium Priority (In Contract). Such traffic is rate limited to 500kbps.

Control Traffic	**Match Criteria**
IETF IPv4 Local Control (inc. OSPF)	MAC addresses 01-00-5E-00-00-00 to 01-00-5E-00-00-FF
IETF IPv6 Local Control (inc. OSPF)	MAC addresses 33-33-00-00-00-00 to 33-33-00-00-00-FF
IEEE Group MAC Addresses	MAC addresses 01-80-C2-00-00-00 to 01-80-C2-00-00-3F
ARP	Ethertype 0x0806

Table 7: Layer 2 Control Traffic

Note: The range of MAC addresses that includes IP control traffic also carries other IP multicast groups. If these groups are used by the customer, then they will be classified as control traffic by the BT service. The customer should take steps to ensure they do not congest this multicast bandwidth otherwise they risk dropping some control traffic.

13.2 CoS and GEA Superfast Etherways

GEA Superfast Etherways only support two CoS options (Default-CoS and Multi-CoS). Standard and Premium are not supported on this Etherway type.

For CoS to work effectively on GEA superfast Etherways, the customer should use VLAN aware Etherways.

13.3 CoS and Copper Etherways

Customers using Copper Etherways for Default-CoS and Multi-CoS EVCs are advised to always mark their traffic priority, even when using Port based Etherways.

14. Quality of Service (QoS)

The Etherflow bandwidths stated in Section 10 includes everything in the Ethernet frame from the Destination address to the Frame Check Sequence. It does not include the following overheads: -

- Preamble (7 octets)
- Start of Frame Delimiter (SFD) (1 octet)

15. Port Types

For each Etherway on an Ethernet VPN the customer can choose between three configuration options:

1. Port Mode (IEEE802.3) – The Etherway will be transparent to all VLAN tags sent by the customer. Only a single EVC can be provided through this configuration.
2. VLAN Aware (segmented) Mode (IEEE802.1q) – The customer will need to tag each frame with a VLAN ID in order to identify which EVC the frame is for.
3. Stacked VLAN Mode (IEEE802.1QinQ) – There are two options for ordering an EVC end-point that terminates on a Stacked VLAN Mode Etherway, as defined below. Note that EVC end-points using Option (a) and Option (b) can co-exist on the same 'Stacked VLAN mode' Etherway -
    a. The customer specifies both the outer SVLAN identifier and the inner CVLAN identifier on the EVC order form. The customer will need to tag each frame with both the SVLAN and CVLAN in order to identify which EVC the frame is for.
    b. The customer specifies the SVLAN identifier and selects the 'wildcard' option for the CVLAN on the EVC order form. The customer will need to tag each frame with the SVLAN in order to identify which EVC the frame is for.

Note that VLAN IDs are unique to each Etherway only. If required, the same VLAN ID can be utilised multiple times on the same VPN. VLAN IDs must be in the range 1 to 4094. Where GEA is used, the range is 2 to 4094 as VLANid 1 is reserved as specified in the GEA SIN 498/506.

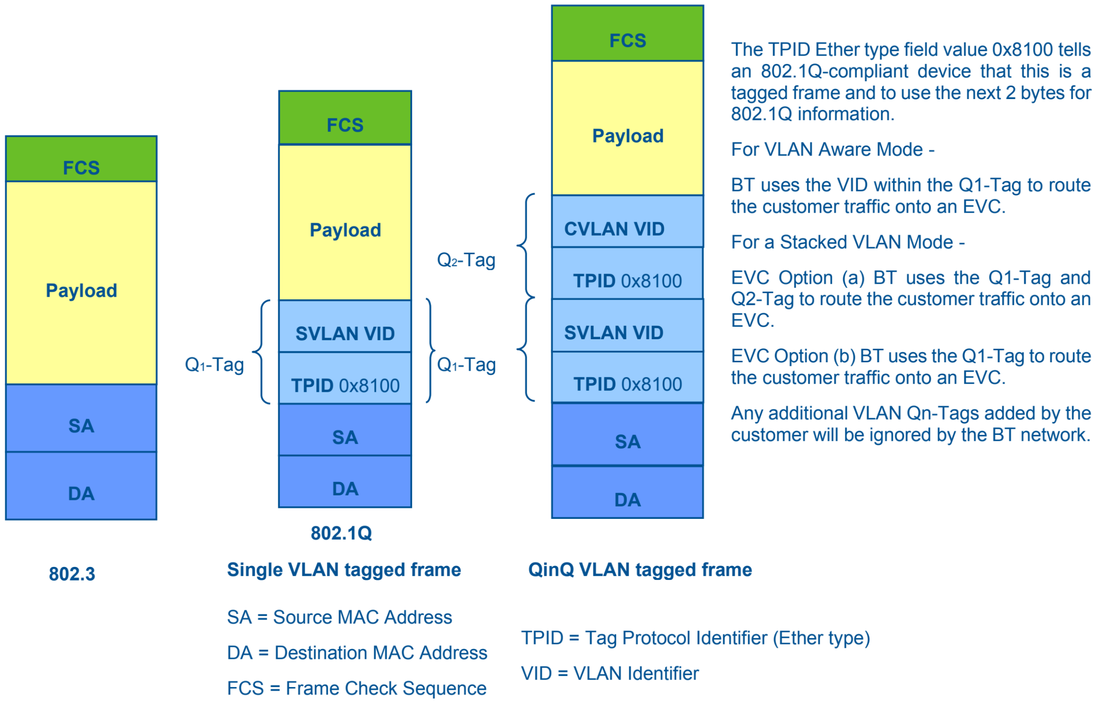
FCS
Payload
SA
DA
802.3
Q1-Tag
FCS
Payload
SVLAN VID
TPID 0x8100
SA
DA
802.1Q
Single VLAN tagged frame
Q2-Tag
Q1-Tag
FCS
Payload
CVLAN VID
TPID 0x8100
SVLAN VID
TPID 0x8100
SA
DA
QinQ VLAN tagged frame
The TPID Ether type field value 0x8100 tells an 802.1Q-compliant device that this is a tagged frame and to use the next 2 bytes for 802.1Q information.
For VLAN Aware Mode -
BT uses the VID within the Q1-Tag to route the customer traffic onto an EVC.
For a Stacked VLAN Mode -
EVC Option (a) BT uses the Q1-Tag and Q2-Tag to route the customer traffic onto an EVC.
EVC Option (b) BT uses the Q1-Tag to route the customer traffic onto an EVC.
Any additional VLAN Qn-Tags added by the customer will be ignored by the BT network.
SA = Source MAC Address
DA = Destination MAC Address
FCS = Frame Check Sequence
TPID = Tag Protocol Identifier (Ether type)
VID = VLAN Identifier

Figure 1: Port Types

In VLAN aware mode the customer must identify each packet using a VLAN tag (using TPID 0x8100). When the frame gets to the BT's Ethernet Edge switch the traffic will be routed to the correct EVC and the tag will be discarded.

In Stacked VLAN Mode, the customer must identify each packet using either two VLAN tags (Option (a)) or one VLAN tag (Option (b)). Both tags should use TPID 0x8100. Note that the use of SVLAN TPID 0x88a8 is not supported (as specified in IEEE802.1ad). When the frame gets to the BT's Ethernet Edge switch, the traffic will be routed to the correct EVC and the tag(s) that were used to route the EVC will be discarded.

Note that Stacked VLAN mode will not be supported on Etherway Radio, Etherway Radio Bespoke Access or Megareach Access (where radio is part of the overall solution) for new provides post 2021/22 FY.

16. Transparency

16.1 Etherflow Connected (ELINE)

BT Ethernet is transparent to the Layer 2 protocols defined below.

Protocol Usage	Destination MAC Address	Layer 2 Control Protocol Handling
Customer Bridge Group Address:- **Spanning Tree STP,RSTP,MSTP**	01-80-C2-00-00-00	Tunnelled and is transparent to the Service
All LANs Bridge Management Group Address	01-80-C2-00-00-10	Tunnelled and is transparent to the Service

Table 8: Etherflow Connected Layer 2 Protocol Transparency

All other Layer 2 protocols generated by the Customer are not guaranteed to be passed across the Etherflow Connected service. The customer should assume that they will be discarded.

All Layer 3 protocols generated by the Customer should be passed across the Etherflow Connected service transparently.

Note that as stated in IEEE 802.1Q, VLAN ids 0 & 4095 are reserved values.

16.2 Etherflow Dynamic (ELAN)

The treatment of Ethernet control protocols across the ELAN is outlined in the following table.

Protocol	Destination MAC	Port Based ELAN	VLAN Based ELAN
STP, RSTP, MSTP	01-80-C2-00-00-00	Tunnelled and is transparent to the Service	Discard*
GARP. MRP	01-80-C2-00-00-20 through 01-80-C2-00-00-2F	Tunnelled and is transparent to the Service	Discard*

Table 9: Etherflow Dynamic Layer 2 Protocol Transparency

*These protocols are discarded if received on an interface for a VLAN based ELAN and are untagged. If the protocols are tagged with the correct VLAN ID then they are tunnelled. However, these IEEE protocols are normally transmitted untagged (not within a VLAN). The operation of the protocol if transmitted within a VLAN is not defined.

All other Layer 2 protocols generated by the Customer are not guaranteed to be passed across the Etherflow Dynamic service. The customer should assume that they will be discarded.

All Layer 3 protocols generated by the Customer should be passed across the Etherflow Dynamic transparently.

16.3 Etherway Superfast GEA

When using a Superfast GEA Etherway, Customers are advised to consider the following: -

- When GEA is used as an access to the BT Downstream 21CN Ethernet Service any IP multicast traffic MUST use a VLAN. If IP multicast traffic is not tagged, or tagged with a VLAN ID of 0, IGMP will not be forwarded transparently across the GEA.
- When GEA is used as an access to the BT Downstream 21CN Ethernet Service any DHCP will have the Option 82 Agent information added. This is added to DHCP that is sent from the GEA connected site and is removed if present from DHCP that is sent to the GEA connected site.
- When GEA is used as an access to the BT Downstream 21CN Ethernet Service any PPPoE traffic will result in additional tags to be inserted into the upstream flow (PADI) by the Intermediate Agent (IA) in the OLT. Any existing tags of the same type from the CPE will be overwritten. The IA tags will be removed by the OLT in the downstream direction (i.e. from the PADO, PADS messages).

See SIN 498/506 for further details.

17. Interface Descriptions

Refer to the following Supplier Information Notes:

- SIN 360 for Ethernet Customer Interfaces
- SIN 489 (OSA)
- SIN 492 (EAD)
- SIN 498 (GEA/FTTC)
- SIN 506 (GEA/FTTP)
- SIN 517 (SoGEA)
- SIN 519 (EAD 10000)
- SIN 1001 (Cablelink)

The customer provides connecting cables between the NTE and their own CPE.

18. References

[1]	SIN 360/ 489/ 492/ 506/ 517/ 519/ 1001	Ethernet Customer Interfaces
[2]	IEEE 802.3 ah	EFM protocol
[3]	ITU-T G.991.2	SHDSL industry standard
[4]	IEEE P802.1p	Protocol used for QoS Marking Ethernet frames
[5]	ANFP	NICC ND1602 “Specification of the Access Network Frequency Plan applicable to transmission systems connected to the BT Access Network” https://niccstandards.org.uk/wp-content/uploads/2019/11/ND1602V7.2.1.zip

Table 10: References

19. Abbreviations

21CN	21st Century Network
ANFP	Access Network Frequency Plan
ARP	Address Resolution Protocol
BT	British Telecommunications plc
CC	Continuity Check
CoS	Class of Service
CPE	Customer Premises Equipment
C-VLAN	Customer Virtual Local Area Network
DWDM	Dense Wavelength Division Multiplexing
EAD	Ethernet Access Direct (Openreach product)
ECC	Excess Construction Charges
EFM	Ethernet in the First Mile
ELAN	Ethernet LAN
E-LMI	Ethernet Local Management Interface
ETHD	Etherflow Dynamic (individual access into an ELAN)
EVC	Ethernet Virtual Connection
FE	Fast Ethernet

FTTC	Fibre to the Cabinet
FTTP	Fibre to the Premise
GARP	Generic Attribute Registration Protocol
GEA	Generic Ethernet Access
GigE	Gigabit Ethernet
IEEE	Institute of Electronic and Electrical Engineers
INU	Indoor Unit of Radio transmission equipment
LACP	Link Aggregation Control Protocol
LAMP	Link Aggregation Marker Protocol
LAN	Local Area Network
LLDP	Link Layer Discovery Protocol
LLU	Local Loop Unbundling (Openreach product)
LT	Link Trace
MAC	Medium Access Control
MD	Maintenance Domain
ME	Maintenance Endpoint
MEF	Metro Ethernet Forum
MPLS	Multi-Protocol Label Switching
MSAN	Multi-Service Access Node
MSTP	Multiple Spanning Tree Protocol
NTE	Network Terminal Equipment.
NTP	Network Terminating Point
OAM	Operations Administration and Maintenance
ODU	Outdoor Unit of Radio transmission equipment
ONT	Optical Network Termination device
OSA	Optical Spectrum Access
OSPF	Open Shortest Path First
PoP	Point Of Presence. In this context a 21C Ethernet Switch site
PWE3	Pseudo Wire Emulation Edge To Edge Router
RSTP	Rapid Signalling Transfer Point
SC/APC	An optical fibre connector type

SHDSL	Symmetric High-speed Digital Subscriber Line
SIN	Supplier Information Note (BT Publication)
STP	Spanning Tree Protocol
SVLAN	Service Virtual Local Area Network
TPID	Tag Protocol Identifier
VID	VLAN Identifier
VPN	Virtual Private Network
VLAN	Virtual Local Area Network
UNI	User Network Interface
WAN	Wide Area Network

Table 11: Abbreviations

20. History

Issue	Date	Changes
Issue 1.0	30 Nov 07	First published.
Issue 1.1	30 May 08	Updated to include WES10 and WES LA
Issue 1.2	17 Jul 08	Updated to include WES1000ER and Auto Negotiate info
Issue 1.3	31 Mar 09	Addition of Ethernet over copper services and update of VLAN tag information. Also minor editorials.
Issue 1.4	25 Sep 09	Updated to include details of EAD delivery and editorial changes
Issue 1.5	25 Nov 09	Updated to include Etherway Exchange connect
Issue 1.6	23 Aug 10	Clarification of IBH hydra cable transmit/receive identification.
Issue 1.7	March 11	Updated to include 10G access.
Issue 1.8	August 11	Updated to include Etherflow Dynamic (ELAN)
Issue 1.9	March 12	Updated to include Etherflow Etherway Radio and Etherway Superfast GEA. Also CoS sections updated.
Issue 1.10	May 13	Updated to include 10G EEC, access resilience table, GEA transparency text updates, physical interface clarifications, QinQ text.
Issue 1.11	June 13	Updated to include Etherway Data Centre Bespoke Access

Issue 1.12	January 2015	Clarification on use of Eline and Elan EVC within ELAN topology. Update on planned Data Centre 10G access solution. Insert of information on treatment of Customer generated layer 3 protocols. Change SINet site references from http://www.sinet.bt.com to http://www.btplc.com/sinet/
Issue 1.13	January 2016	Updated to include Etherway Hull Bespoke Access, Etherway 10G Bespoke Access, GEA FTTC Wires only and Large Etherflow detail.
Issue 1.14	April 2017	Editorial changes to ToC
Issue 1.15	April 2018	General editorial changes plus the inclusion of 10G Etherflow and 10G Etherway Bespoke support
Issue 1.16	June 2018	Updated Sections 4.6 and 6 to include appropriate text on 10GE Data Centre service presentation.
Issue 1.17	July 2018	Updated to include Etherway Mobile Access
Issue 1.18	September 2019	Updated to include 10G ELAN support and 1000Base-T electrical client interface support, both of which are in development and will be launched soon. Also removed Etherway Mobile Access which will not be launched.
Issue 1.19	July 2020	Change SINet site references from http://www.btplc.com/sinet/ to https://www.bt.com/about/sinet
Issue 1.20	September 2020	Updated to include enhancements to the various radio access solutions and the introduction of Megareach Access
Issue 1.21	July 2021	Clarified FTTP/FTC MTU frame size support.
Issue 1.22	June 2022	Updated to include 100Gbps Data Centre Access
Issue 1.23	April 2023	Removed WES based Etherways options. Included 100Gbps EEC option Included references to SOGEA access support Validated auto-negotiation behaviour on Megareach Clarified new Openreach EAD NTE types used Updated access resilience support table Clarified TPID values supported on QinQ Stags Added Table/Figure captions

		Added Openreach SIN references
Issue 1.24	April 2024	Updated Table 4 to indicate support for 9000bytes service frames. Other minor updates included.

-END-